

**Emotion Regulation and Delayed Discounting:
The Development of an Emotional Discounting Paradigm**

Honors Research Thesis

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By

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Abstract

When we are confronted with threats, it can quite reasonable for us to escape. However, the habitual avoidance of potential threats can interfere with our ability to adaptively engage with the environment and it has been associated with the development and maintenance of anxiety disorders and with problems regulating emotions (e.g., Aldao et al., 2010; Hayes et al., 1999; Hoffman et al., 2012; Roemer et al., 2008). Thus, a critical questions entails identifying the point at which avoidance might no longer confer an advantage. I modified a monetary discounting paradigm to capture individual differences in how people avoid an impending negative emotional experience. I administered a monetary discount paradigm capturing impulsivity and an emotional discounting paradigm assessing avoidance. Undergraduate students (N=177) were asked to: 1) make decisions between taking a small amount of money (varying in amount) or taking a chance of receiving a larger amount (varying in probability) (monetary discounting) and 2) make decisions between watching short disgust-eliciting film clips for certain (varying in length) or taking a chance of having to watch a longer film clip (varying in probability) (emotional discounting). Larger discounting rates reflected greater impulsivity and avoidance, respectively. Discounting rates in the monetary paradigm were linked with more symptoms of generalized anxiety disorder, OCD, and social anxiety and with more emotional difficulties. Performance on the emotional discounting was not associated with individual difference or with performance on the delay discounting paradigm. Future work should 1) examine the links between emotional discounting and symptoms in clinical populations, 2) test the link between emotional discounting and physiological markers of emotion regulation.

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Background

In the past two decades, there has been a growing interest in understanding the mechanisms by which individuals manage – or regulate – their emotions in order to respond to environmental demands (e.g., Gross, 1998). In particular, difficulties with emotion regulation have been associated with a wide range of mental disorders, ranging from anxiety and depression to schizophrenia and personality disorders (e.g., Aldao, Nolen-Hoeksema, & Schweizer, 2010; Kring & Sloan, 2009). Certain emotion regulation strategies have been found to have negative associations with symptoms and have therefore been conceptualized as adaptive (e.g., acceptance, cognitive reappraisal). Conversely, other strategies have been shown to have positive associations with symptoms and have been described as maladaptive (e.g. avoidance, suppression, rumination). Yet, despite the usefulness of such a heuristic, there are many instances in which putatively adaptive strategies might be detrimental (e.g., if we reappraise a situation to such an extent that we deny important facts). Similarly, there are times in which the putatively maladaptive strategies might confer benefits (e.g., suppressing anger at our boss might help us receive a better performance review). In other words, the usefulness of a given strategy is highly influenced by the contextual factors surrounding its implementation (for a review, see Aldao, 2013; Aldao & Christensen, 2015; Bonanno & Burton, 2013). Yet, because modeling contextual factors in controlled laboratory settings can be quite challenging, researchers have largely abstained from embarking on such endeavors when studying emotion regulation. Consequently, the field only has a limited understanding of the process by which maladaptive strategies might serve adaptive functions and vice versa. In my thesis, I address this limitation in

the literature by developing a paradigm that allows me to identify the turning point in which the use of a maladaptive strategy (avoidance) might become beneficial. Specifically, I developed a modified delayed discounting paradigm in which I evaluated individual differences in the costs and benefits of avoiding emotions and how these differences, in turn, relate to psychopathology and emotion regulation skills.

What is Delayed Discounting?

Imagine being a child sitting at a table in a room by yourself, with a delicious marshmallow in front of you. Now imagine being told that if you wait until an adult comes back, you will get a second marshmallow, but if you eat the first before they return, that is all you get. This “marshmallow experiment” (Mischel, Ebbesen, & Zeiss, 1972) marked the beginning of the study of people’s ability to delay an immediate gratification for the sake of obtaining a larger reward later. Being able to wait for the second marshmallow has been associated with a wide range of beneficial outcomes later in life, including improved academic performance and lower rates of psychopathology (e.g., Mischel, et al., 2011). More recently, the marshmallow paradigm has been adapted to the study of delayed gratification in adults. Specifically, the delayed discounting paradigm captures the process by which people prefer a small reward in the present over larger reward in the future (e.g., accepting \$2 now instead of \$10 in a week). In other words, it reflects the extent to which people discount the value of a future reward as the wait time increases (e.g., Myerson & Green, 1995). Pertinent to this investigation, larger discounting rates (i.e., preferring smaller rewards in the present) have been associated with various mental disorders, including substance abuse (e.g., alcohol; Richards, Zhang, Mitchell, & De Wit, 1999; smoking; Reynolds, Richards, Horn, & Karraker, 2004), attention deficit hyperactive disorder

(ADHD; e.g., Scheres et al., 2005), schizophrenia (e.g., Wing, Moss, Rabin, & George, 2011), and social anxiety (e.g., Rounds, Beck, & Grant, 2007).

In a monetary delayed discounting paradigm, participants are presented with a series of choices between receiving a reward now or a much larger reward later. The amount of the current reward and the duration of the delay are systematically varied whereas the amount of the delayed reward is held constant. For each delay, participants choose between each of the available rewards now versus a fixed reward later. The smallest value of a reward the participant is willing to obtain in the moment is referred to as the “indifference point” and it represents participants’ subjective value of the delayed reward. After researchers identify an indifference point for each of the delays, they can plot a discount function: the indifference points are plotted on the Y-axis against the delays, which are plotted on the X-axis in ascending order. Steeper curves represent that, at each possible delay, participants are more willing to take the lower amount of money now rather than wait for the larger reward later. In other words, they are more likely to discount the subjective value of future rewards as the delay increases. While there are several different ways to calculate discounting rates from these curves, hyperbolic functions have been shown to be the best predictors (e.g., Myerson & Green, 1995), and therefore, is the method I used in this thesis.

A variant of delayed discounting is probability discounting. In this case, instead of choosing between a greater reward in the future versus a smaller reward in the present, participants are presented with a choice of a certain but small reward versus an uncertain but larger reward (e.g., receive \$2 for certain versus taking a 30% chance of receiving \$10). Thus, larger rates of probability discounting capture participants’ preferences for certainty over uncertainty – even when uncertain options might be more beneficial for them. Probability

discounting paradigms are particularly well suited for investigations in which it is conceptually or methodologically not feasible to deliver the reward at a later point. For that reason, a probability discounting paradigm constituted the basis of my paradigm.

What is Emotional Discounting?

In addition to experiencing difficulties waiting for delayed rewards, people also have a tendency to postpone the experience of negative emotions (e.g., Hayes, Strosahl, & Wilson, 1999). This propensity is not intrinsically maladaptive; sometimes avoidance can be useful, as when it allows us to not get caught up in difficult emotions and carry on with a particular task. Indeed, having flexibility in the use of avoidance (and other strategies) might be key to a healthy emotional life (e.g., Hayes et al., 1999; Kashdan & Rottenberg, 2010). Yet, many individuals end up relying on avoidance chronically and inflexibly and consequently experience difficulties regulating their emotions. Moreover, such patterns of inflexible avoidance have been associated with the development and maintenance of various forms of psychopathology, in particularly anxiety disorders (e.g., Hayes et al., 1999; Mennin & Fresco, 2009; Roemer, Orsillo, & Salters-Pedneault, 2008). Thus, I developed a laboratory paradigm that allows me to delineate the point at which the benefits of avoidance no longer outweigh its costs.

I conceptualized *emotional discounting* as the process by which people discount the benefits of avoidance. In other words, it reflects the rate at which individuals are willing to let go of their natural tendency to avoid their emotions because the costs of doing so have become too high. In my task, I presented participants with two choices: 1) experience a certain but shorter negative emotion; versus 2) experience an uncertain but longer negative emotion. Insofar as the uncertain but longer emotion has a low probability of occurring, it is beneficial to choose it (i.e., avoid the certain but shorter negative emotion). Yet, as the probability of having to experience a

negative emotion increases, it becomes less and less beneficial to select it over the certain but shorter emotion. In other words, participants might be better off adopting a “bandaid” approach and experiencing a certain but short negative emotion rather than placing a bet that might lead them to experience a prolonged negative emotion. Greater rates of emotional discounting will be indicative of a person being more sensitive to the moment in which avoidance might no longer be beneficial.

Of note, I based my paradigm on a probability discounting paradigm, rather than a delay discounting paradigm because with a delay discounting paradigm, participants might be motivated to choose the longer but uncertain and then skip the follow-up session altogether. In other words, in such a design, avoiding the short but certain emotion might always be adaptive – provided one does not come back to the lab. On the other hand, with a probability discounting paradigm, all participants will have to experience a negative emotion in that very session. Thus, the context is presented in such a way that there is a definite point at which avoidance might no longer be beneficial.

Hypotheses

I expected that participants would vary in their emotional discount rates and that such variation would be associated with emotion regulation and psychological well-being. Specifically, I hypothesized that the participants who discounted in the monetary task (which reflects greater impulsivity) would report higher levels of anxiety and depression, greater use of maladaptive emotion regulation strategies (i.e., rumination and suppression), lower use of adaptive emotion regulation strategies (i.e., reappraisal), and more difficulties with emotion regulation skills. Similarly, I expected that participants who discounted more in the emotional discounting paradigm (which reflects greater avoidance) would also report greater use of

maladaptive emotion regulation strategies (i.e., rumination and suppression), lower use of adaptive emotion regulation strategies (i.e., reappraisal), more difficulties with emotion regulation skills, and higher levels of anxiety and depression. Also, I expected a minor correlation between the two tasks, showing that the tasks were related, but tapping into separate processes.

Method

I ran this study in Dr. Amelia Aldao's Psychopathology and Affective Sciences (PAS) lab and I was responsible for setting up the task, coordinating participant recruitments, training research assistants on the study protocol, cleaning and analyzing data, and writing up the findings. I recruited 177 undergraduate participants via flyers posted around campus. However, after data analysis, I excluded participants for a variety of reasons (e.g., missing data, extreme values (i.e., k higher than 9.7 in the monetary discounting task, and k higher than 4 in the emotional discounting task), failure to follow directions), resulting in a final sample of 129. They participated in a 2-hour study and received fifteen dollars for their participation. Participants arrived at the lab where one of the RAs walked them through the informed consent procedures. I then administered a series of self-report questionnaires on Qualtrics.

Individual Differences in Anxiety and Depression

Generalized Anxiety Disorders Questionnaire – IV (GAD-Q-IV; Newman et al., 2002). The GAD-Q-IV is a 9-item self-report measure that assesses symptoms of GAD. Five items are dichotomous and measure the excessiveness and uncontrollability of worry, one item is open-ended and asks for a list of the most frequent worry topics, two items on a 9-point scale measure the clinical distress and functional impairment associated with excessive worry and anxiety, and a final item asks about the presence of each of the six physical symptoms

outlined in the DSM-IV criteria for GAD. Total scores range from 0 to 13 and a clinical cutoff of 5.7 has been identified (e.g., Newman et al., 2002). The GAD-Q-IV has shown good concurrent validity, test-retest reliability, and the ability to differentiate individuals with clinical and non-clinical levels of GAD (e.g., Newman et al., 2002).

Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). The SIAS is a 20-item self-report inventory that assesses symptoms of social anxiety disorder, particularly anxiety experienced in dyads or groups. Items are scored on a 5-point scale ranging from 0 to 4 and total scores range from 0 to 80. A score of 34 has been identified as a clinical cutoff score (Brown et al., 1997). The SIAS has demonstrated excellent internal reliability in both clinical and undergraduate samples (α 's > .89; Mattick & Clarke, 1998).

Social Phobia Scale (SPS; Mattick & Clarke, 1998). The SPS is a 20-item self-report inventory that assesses symptoms of social anxiety disorder, particularly fears of being observed by others (e.g., public speaking, eating in public). As with the SIAS, items are scored on a 5-point scale ranging from 0 to 4 and total scores range from 0 to 80. A score of 24 has been identified as a clinical cutoff score (Brown et al., 1997). The SPS has demonstrated excellent internal reliability in both clinical and undergraduate samples (α 's > .89; Mattick & Clarke, 1998).

Obsessive Compulsive Inventory – Revised (OCI-R; Foa et al., 2002). The OCI-R is an 18-item self-report measure that assesses symptoms of obsessive compulsive disorder over the past month. It has 6 subscales (Washing, Checking, Obsessing, Ordering, Neutralizing, Hoarding). It has shown excellent internal consistency (α 's > .83; Foa et al., 2002).

Mood and Anxiety Symptom Questionnaire (MASQ; Watson et al., 1995). The MASQ (Watson et al. 1995) is a 62-item measure that assesses symptoms that commonly occur

in anxiety and mood disorders. The Anxious Arousal subscale consists of 17 items that assess anxiety-specific symptoms and the Anhedonic Depression subscale includes 22 items that assess symptoms specific to depression. The item assessing suicidal ideation was not included. Watson and colleagues (1995) reported good internal reliability in multiple samples (all α 's greater than .78).

Individual Differences in Emotion Regulation

Strategies. *Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004).* The AAQ is a 9-item measure of experiential avoidance, and was used to assess the maladaptive strategy of avoidance. This measure has been shown to have adequate internal consistency ($\alpha = .70$) and adequate convergence with other measures of emotion regulation (Hayes et al., 2004).

Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). The ERQ measures the habitual use of two emotion regulation strategies: the adaptive strategy of cognitive reappraisal (6 items) and the maladaptive strategy of expressive suppression (4 items). It has been extensively used in the literature on emotion regulation and has been shown to have good to very good internal consistency (α 's for reappraisal $> .75$; α 's for expressive suppression $> .68$; Gross & John, 2003).

Skills. *Difficulties with Emotion Regulation Scale (DERS; Gratz & Roemer, 2004).* The DERS is a 36-item measure that assesses habitual difficulties regulating emotions on several dimensions. Items are rated on 5-point scales with higher scores indicating greater difficulties regulating emotions. The DERS can be calculated as a total score or as 6 individual subscales (i.e., Nonacceptance of Emotional Responses, Difficulties Engaging in Goal Directed Behavior, Impulse Control Difficulties, Lack of Emotional Awareness, Limited Access to Emotion

Regulation Strategies, and Lack of Emotional Clarity). The DERS total score and the subscales have shown very good internal consistency (α 's > .84; Gratz & Roemer, 2004).

Discounting Tasks

The monetary discounting task assessed the extent to which they preferred a smaller reward for certain (ranging from \$1 to \$9) or take a chance (5%, 25%, 50%, 75%, 95%) of obtaining a larger reward (\$10). In the emotional discounting task, participants had to choose between watching a disgust eliciting film clip for certain (ranging from 1 to 9 minutes) or take a chance (5%, 25%, 50%, 75%, 95%) of having to watch a 10-minute long film clip. I programmed both tasks on Medialab. The participants then completed a picture task in which they are shown various pictures of different levels of disgust. This task was used for a second researcher's project and had no expected consequences on my project of interest.

From the discounting tasks, I calculated a single value to determine the level of impulsivity (for the monetary discounting) or level of avoidance (for the emotional discounting). This value was labeled k , and stood for the hyperbolic function that would be required to create a curve for that participants indifference points at each probability level. The indifference point was calculated by finding the point in the task in which the participant would switch between taking the chance of a larger amount to taking the for sure smaller amount for the monetary task. In this task, I coded the indifference point as the highest amount that the participant would take for sure. For the emotional discounting, the indifference point was coded for when the participant switched from taking the smaller video length to taking the chance at having to watch a longer video. In this task, the indifference point was coded at the lowest length where the switch occurred. These values were then ran through an excel spreadsheet that would calculate the k value for the participant (Reed et al., 2012). The higher k value for the monetary discounting

indicated higher levels of impulsivity, while higher k values for the emotional discounting indicated higher levels of avoidance. The k value was calculated for each participant based upon the indifference points at the percentage values of 95%, 75%, 50%, 25%, and 5%.

Results

In order to test my hypotheses, I used SPSS to test both the correlations between the tasks and the self-report measures. First, the monetary discounting was significantly correlated with GADQ ($r = .233$; $p < .05$), SPS ($r = .217$; $p < .05$), OCI checking subscale ($r = .273$; $p < .05$), Anxiety Symptoms ($r = .204$; $p < .05$), DERS Awareness subscale ($r = -.197$; $p < .05$), and DERS Strategies subscale ($r = .176$; $p < .05$). Conversely, the relationships between the emotional discounting and the self-report questionnaires were not significant (see Tables 1 and 2). The two discounting tasks were found to have no significant correlation between them ($p = .20$).

Table 1. Monetary Discounting Paradigm Correlations

Self-Report Measure	<i>r</i>
GADQ No Skipout	.233**
GADQ Skipout	.227*
SIAS Total	.171
SPS Total	.217*
OCI Checking Subscale	.273**
OCI Hoarding Subscale	.032
OCI Neutralizing Subscale	-.023
OCI Obsessing Subscale	.099
OCI Ordering Subscale	.092

OCI Washing Subscale	-.154
OCI Total	.123
MASQ AA Subscale	-.075
MASQ Depression Subscale	.115
AAQ Total	.081
Anxiety Symptoms	.204*
ERQ Reappraisal Subscale	-.043
ERQ Suppression Subscale	.024
DERS Awareness Subscale	-.197*
DERS Clarity Subscale	-.017
DERS Goals Subscale	.103
DERS Impulse Subscale	.041
DERS Non-acceptance	-.017
Subscale	
DERS Strategies Subscale	.176*
DERS Total	.042

p values less than .05 are denoted with *; p values less than .01 are denoted with **

Table 2. Emotional Discounting Paradigm Correlations

Self-Report Measure	<i>r</i>
GADQ No Skipout	.062
GADQ Skipout	.084
SIAS Total	-.040
SPS Total	.164

OCI Checking Subscale	-.135
OCI Hoarding Subscale	.080
OCI Neutralizing Subscale	.011
OCI Obsessing Subscale	.076
OCI Ordering Subscale	.046
OCI Washing Subscale	-.022
OCI Total	.018
MASQ AA Subscale	.122
MASQ Depression Subscale	.084
AAQ Total	.111
Anxiety Symptoms	.100
ERQ Reappraisal Subscale	.078
ERQ Suppression Subscale	.005
DERS Awareness Subscale	.033
DERS Clarity Subscale	.100
DERS Goals Subscale	.086
DERS Impulse Subscale	-.014
DERS Non-acceptance	.107
Subscale	
DERS Strategies Subscale	.149
DERS Total	.118

p values less than .05 denoted with *; p values less than .01 denoted with **

Discussion

The results from this study shed more light onto the relationship between discounting behavior, symptoms of anxiety and mood disorders, use of emotion regulation strategies, and the presence of emotion regulation skills. First, the monetary discounting paradigm was correlated with symptoms of GAD, OCD, and social anxiety, and low levels of emotional awareness. Such findings extend the literature on impulsivity by suggesting that it might play a role across a number of anxiety disorders. For example, people with GAD might impulsively respond to their anxiety by engaging in worry, people with social anxiety may impulsively respond to overwhelming situations by leaving, and people with OCD may lose control and engage in compulsions more frequently due to their impulsivity. Similarly, people with difficulties identifying their emotion might be more likely to react impulsively in the face of intense feelings. In all, these findings are aligned with the transdiagnostic approach to psychopathology, suggesting that dysfunctional processes are implicated in a number of different disorders (e.g., impulsivity is a problem in both substance abuse issues and also anxiety disorders) (see Aldao et al., 2010; Kring & Sloan, 2010). In this respect, it will be important to recruit clinical samples in order to evaluate the extent to which these associations are disorder-specific versus transdiagnostic (e.g., Kring & Sloan, 2010).

It should be noted that the new paradigm for emotional discounting was not correlated with any of the self-report measures that were administered. There are a few possible interpretations for these null findings. One possibility is the task in its current form does not appropriately capture the construct of avoidance as was originally hypothesized. This could be due to the risk/reward nature of the paradigm. While I conceptualized the task as a way to capture avoidance when the participant decided to take a chance of watching the longer video in

order to avoid the emotion altogether. However, participants could have chosen the chance due to the thrill of taking a risk.

Another interpretation is that the videos used were not disgusting enough to elicit strong emotionality – and thus, a need for avoidance. A possible explanation for this could be the fact that the videos used were taken from the television show *Fear Factor*. While the clips are disgusting, they are not from a tested source that is shown to elicit disgust across multiple participants. Also, some people may have watched the show for fun, and therefore, the disgust of the videos could be overridden by the enjoyment of the show from a background knowledge that the participant brought into the study with them. Future versions of this task could modify the stimulus for disgust by finding a normalized disgust eliciting video or using some other stimulus that has been experimentally tested to elicit disgust in a majority of participants.

It is also possible that participants might have been motivated more by the factor of time as opposed to the emotional images. In other words, the participant may have selected the probability chance due to the hope of saving time as opposed to avoiding disgust. If this were the case, the task may have tapped into time management more so than into avoidance. Lastly, it is feasible that because I utilized an unselected undergraduate sample, there might have been a restriction of range in performance on the emotional discounting as well as on the self-reports of emotion regulation and symptoms that might have prevented me from detecting important differences. In this respect, it will be very important for future studies to test this paradigm in individuals experiencing substantial emotion regulation difficulties and/or suffering from clinical levels of anxiety and depression.

This study had a number of limitations that warrant further discussion. First, I tested cross-sectional associations. It will be important for future research to evaluate the longitudinal

associations between discounting behavior (both monetary and emotional) and mental disorders. Another possible direction for future direction of research off this task would be to run more participants through the emotional discounting paradigm to determine if the task can be found to correlate with other symptoms of psychopathology or if other regulation strategies (e.g., rumination, worry) are linked to avoidance

In conclusion, the findings from the study suggest that impulsivity might be a transdiagnostic factor cutting cross anxiety disorders, in particular GAD, OCD, and social anxiety disorder. In addition, impulsivity was associated with lower emotional awareness, thus suggesting that it might be linked with core emotion regulation deficits. However, further work remains to be done in terms of refining the emotional discounting paradigm in order to reflect patterns of avoidance. Hopefully future work will be able to better delineate the link between impulsivity and avoidance in relation to mental health and emotion regulation.

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